Evaluation of Steric Effect of Hydroquinone, Tert-Butyl Hydroquinone and 2, 5-Ditert-Butyl Hydroquinone by using a Briggs-Rauscher Oscillator

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This article indicated a novel methodology of evaluation of steric effect of (hydroquinone (HQ), tert-Butyl hydroquinone (TBHQ) and 2, 5-ditert-butyl hydroquinone (DTBHQ)) by using a Briggs-Rauscher chemical oscillating system. The macro cyclic $[\text{NiL}](\text{ClO}_4)_2$ complex catalyst with 5,7,7,12,14,14-hexamethyl-1,4,8,1,1-tetraazacyclotetradeca-4,1,1-diene as ligand is used. The calculated experimental data confirmed the diverse perturbation effects of all three additives towards the active Briggs-Rauscher oscillator in their concentration ranges from 5.0×10^{-7} M to 1.25×10^{-5} M. Hydroquinone generate inhibition time (t_{in}) higher than t-BHQ, whereas, no influence of 2,5-DBHQ were observed in Briggs-Rauscher system. Our claim for such differences in perturbation is due to the strong steric hindrance effect of these additives. The presence of bulky group (tertiary butyl) reduces the reactivity of the antioxidants by covering the active sides (OH-group) from the attack of $\text{HOO}^\bullet$ radical. Thus, Hydroquinone produced larger t_{in} because of absence of bulky group, the shorter t_{in} of t-BHQ due to the presence of one bulky group whereas, no t_{in} of 2, 5-DBHQ because of two bulky groups attached. The perturbation reaction mechanism was discussed on the basis of FCA (Furrow-Cervellati-Amadori) model. The explanation mechanism is that both HQ and t-BHQ is oxidized by $\text{HOO}^\bullet$ into their respective Quinone.

Keywords: Antioxidant; Briggs-Rauscher; Antioxidants; Inhibitory effect; Steric effect

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